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Abstract

Dairy farmers in Bihar are mostly smallholders having one or two local-bred milch animals, which are raised on crop residues and natural pastures with under-employed family labour. Feeding grains, oil cakes and green nutritious fodder are limited to crossbred cattle. Feed and fodder deficiencies are major limiting factors in raising livestock productivity. Fodder markets are important for communities, which have limited ability to produce their own fodder, but need quality fodder at reasonable prices to produce milk at competitive cost and trading is an important livelihood activity for poor who engaged in it. The study tries find ways to improve the livelihoods of resource-poor livestock producers by alleviating fodder scarcity. Livestock being an important source of livelihood in Bihar, the study has a direct poverty relevance for state. The findings indicate a huge gap between demand and supply of both dry and green fodder. South Bihar is fodder surplus area because of irrigated cultivation of paddy and wheat, while north Bihar is fodder deficit and depend on fodder surplus regions. There are no dedicated market places so, trading takes place along roadsides and without legal credentials. Fodder being a bulky item, makes its trading and handling difficult. Some traders do use compressing machines to make fodder blocks. Development of technology for cost-effective and nutritive feed requires urgent attention and here public sector R&D can play an effective role which can also be done in public-private partnership mode.

Key Words: Fodder markets, Fodder deficit, Feeds, Bihar, India

Introduction

Livestock production, especially dairy, has long been an important activity for smallholder and resource-poor farmers in India, both for household nutrition and income. Most of the livestock are kept in mixed farming systems, where crop residues—mainly cereal straws—have been an important feed resource (NIANP 2003). India is deficient in the supply of fodder, resulting in very low level of productivity that limit marketable surplus of milk. In Bihar, over 50% of the land area is planted to rice, and rice straw along with wheat straw and some pulse residues form the main animal feeds. Recent studies in the Indo-Gangetic Plain have highlighted the problem of insufficient fodder and the poor nutritive value of fodder, a problem which becomes more acute in the more eastern parts of the region where agricultural resources—particularly arable land and water—become scarcer (Erenstien et al. 2007). This fodder scarcity affects most farmers but is particularly acute for landless and those with access to only small area of land.

Chronic feed deficit is the major constraint to animal production in Bihar. Most of the dairy farmers are smallholders having one or two local-breed milch animals, which are raised on crop residues and natural pastures with under-employed family labour. Feeding grains, oil cakes and green nutritious fodder are generally restricted to some crossbred cattle. The feed and fodder deficiencies, in fact, have been the main limiting factors in raising livestock productivity. (Singh et al. 2013).

However, especially in India's poor eastern states, the growth of the rural population is still leading to decreasing farm size, while rising demand for milk and improving marketing opportunities stimulate continuous growth in dairy production. Thus, the availability of fodder is a serious issue, especially for resource-poor livestock keepers with little or no land for cultivation (Singh et al. 2012). The level of this constraint varies temporally and spatially, creating scope for storage and trade. It has been observed that farmers generally store a considerable proportion of their harvested fodder and that large amounts of fodder are traded, both locally and over longer distances. But the structure and functioning of those markets are poorly understood and opportunities for improving the efficiency of fodder marketing as a potential tool contributing to the alleviation of fodder scarcity have not been adequately explored (Singh et al. 2012).

Fodder markets are important particularly for the poorest and landless sections of these communities, which have very limited ability to produce their own fodder, but need access to quality fodder at reasonable prices to be able to produce milk economically and at competitive cost. Fodder trading is also an important livelihood activity for the poor who engage in it directly or who are employed in this value chain.

The overall objective of the study was to improve the livelihoods of resource-poor livestock producers by alleviating fodder scarcity. The specific objectives of the project were development of a systematic understanding of fodder markets.

Materials and Methods

The study was conducted in Bihar because it is amongst the poorest states in the region, and livestock is an important source of livelihood, enabling a direct poverty relevance of the study's findings. Its agricultural sector is diverse and its crop production is residue based fodder. The share of cereals in the cropping pattern as well as the shares of

individual cereals varies across districts within the state, which has implications for quantity and quality of fodder. Both wheat and rice straws are widely fed in this state located between rice oriented eastern and wheat focused north-western states.

Participatory Rural Appraisal (PRA) technique was adopted to obtain relevant information of preliminary picture of the market. Discussions with key informants indicated that there are five types of actors that are important in fodder markets in the state: producers, traders, commission agents/wholesalers, retailers and consumers. Twelve semi-formal interviews were conducted with representatives of each of these type participants in four identified districts i.e., 2 in the surplus zone (south Bihar) and 2 in the deficit zone (north Bihar) to draw an overall picture of fodder marketing in Bihar (Table 1).

Table 1: District wise number of participants in FGD

Region	Districts	Category-wise number of participant			
		Producer / farmer	Fodder trader	Retailer	Consumer
Surplus	Patna	3	3	-	3
	Jehanabad	3	3	-	3
Deficit	Vaishali	3	5	1	5
	Begusarai	3	3	3	3
Total		12	14	4	14

These Focus Group Discussions (FGDs) were organized at 12 sites in the state with the help of scientists of the Sanjay Gandhi Institute of Dairy Technology, Patna and the State Farmers' Commission, Bihar. At each site, some producers, assemblers, traders (vendors, retailers and wholesalers), and commission agents from fodder markets were assembled and discussions on different aspects of fodder marketing were held.

Results and Discussion

Important forage and concentrate feeds

Crop residues and by-products are the key components of livestock feed. Dry fodder constitutes the largest proportion of fodder accounting for about 89% of the feed requirement. Straws of paddy and wheat together contribute to about 95% of dry fodders consumed by livestock in Bihar (Table 2). The proportion of green fodder in total livestock feed is close to 11%. About 55% of green fodders are cultivated. Maize, sorghum, berseem, napier grass, and some of the legume species are mostly cultivated. The stovers of green maize and sorghum account for about 30% of the total green fodder, particularly in maize growing areas, and berseem and napier grass constitute 20% of the green fodder. Cut grasses, weeds and rogues are also important sources of green fodder—accounting for about 40% of the green fodder—and fed to the livestock after chopping. In addition, leaves of some trees and banana trunk also supplement green fodder.

Table-2: Important forage (dry and green) consumed in sample districts

Type of feed	Important items
Dry fodder (89%)	<ul style="list-style-type: none"> • Wheat straw (40%) • Paddy straw (55%) • Pulses straw (2%) • Maize stover (1%) • Others (2%)
Green fodder (11%)	<ul style="list-style-type: none"> • Grasses, rogues and weeds (40%) • Stover green (maize, sorghum) (30%) • Other cultivated fodder crops (Napier grass, Berseem, etc.) (20%) • Legumes (lathyrus, peas, etc.) (5%) • Leaves (peppal, banyan, Jackfruit, Madras thorn, bamboo, subabul, ziziphar, etc) & trunk (banana) (5%)

Storage

Every household that owns livestock stores fodder for future use. Storage practices differ according to types of feed items. Generally, paddy straw is stored in a corner of a courtyard in the open. The loose piles of paddy straw are stacked together. This type of storage is common in the areas where paddy is harvested by combine. The next important practice is storage of paddy straw in heaps/bundles arranged in a cylindrical shape covered by a conical shaped cap made of paddy straw/thatch in the fields or near the dwelling house (Table 3).

Table- 3: Methods of fodder storage in Bihar.

Type of fodder	Open	In dwelling house	Bamboo structure	Under thatched roof
Paddy Straw (Pual)	+++	+	-	-
Paddy Straw (Newari)	+++	+	-	-
Paddy Straw (chopped)	-	++	++	+++
Wheat Straw	-	+++	+++	+++
Pulses Straw	-	+++	+	++

Source: Primary level survey, +++ indicates most common practice

The conical shape of the cap prevents water from percolating inside the heap and the whole pile of straw remains unaffected except a thin layer on the top. Sometimes when the quantity is fairly small, paddy straw is also stored in the dwelling house.

Chopped paddy and wheat straws are never stored loose in the open. Most of the time, these are stored in the dwelling houses of the producers or the users. Special bamboo storage structures (locally known as *bukhari*, *bhuskar*, etc.) are also built and used to store chopped paddy and wheat straws solely or along with food grains. Some affluent, big producers and traders have also constructed cemented structures to store fodder and grain.

Fodder marketing channel

Fodder marketing in Bihar has no formal organized structure or formal institutional support. Paddy and wheat straws are the major traded fodders. Green fodder is also traded but its proportion is quite insignificant. Fodder marketing involves a number of actors along the supply chain.

The most common fodder supply chain begins with the producers and proceeds further along a number of different channels with the help of various kinds of actors such as assemblers and small vendors, commission agents, retailers, wholesalers and processors, and ends with the ultimate users who are scattered across the state.

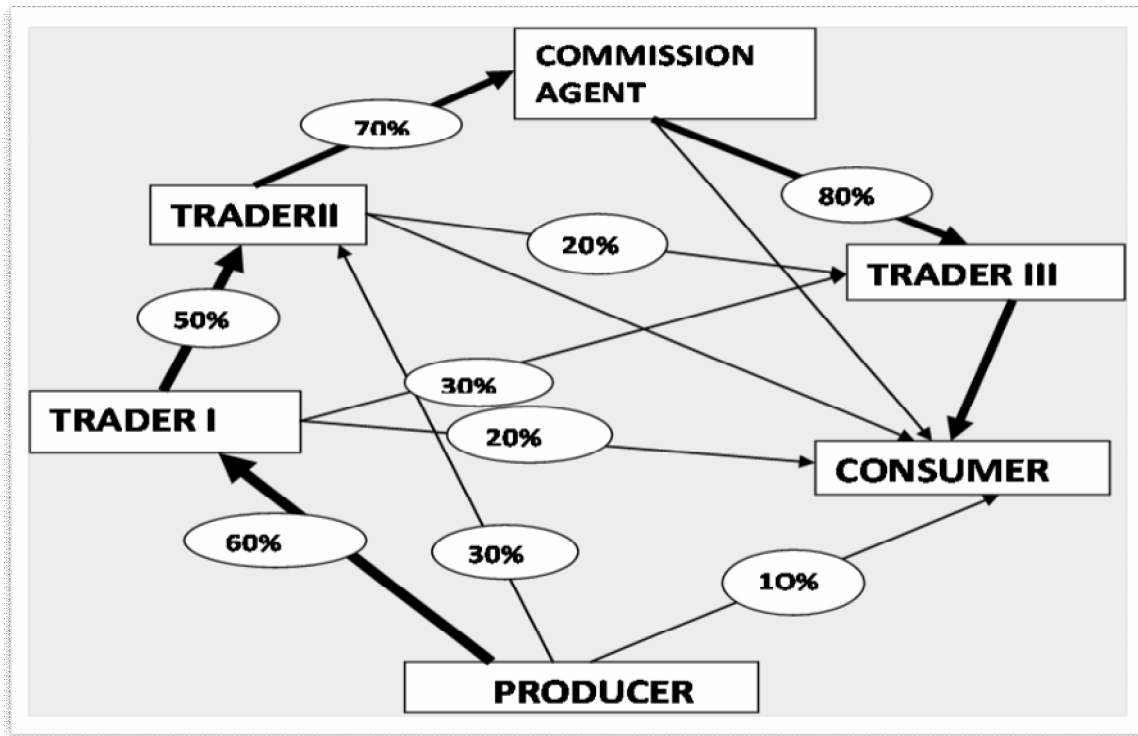


Figure 1: Flow of fodder transactions among different actors in Bihar

There are five main actors or points of action in the wheat and rice straw supply chain: producer, trader-1 (vendor), trader-2 (wholesaler), trader-3 (retailer) and consumer. In between, there are other small actors such as bullock cart owners, assemblers, and commission agents who serve different principal agents to facilitate transactions (Figure I). About 60% of the marketed surplus of straw is sold by producers to trader-1 and 30% to trader-2 and 10% to consumers directly. There are many retailers who maintain good contacts with producers and purchase fodder directly from them. The longest supply chain involves the producer, trader-1, trader-2, commission agents, trader-3 and finally the ultimate consumers.

Mode of transport and communication

Different types of means of transport are used to carry fodder from one place to another, depending on distance and purpose of transportation. Head loads are common for

transportation of green fodder from the field to farms for self use. For localized fodder (<10kms), mainly bullock carts are used. A bullock cart load of wheat straw fetches a price of Rs. 1200-1500 and roughly weighs 4 to 5 quintals. A number of bullock carters (*bail gadiwalas*), particularly in fodder surplus zones, are involved in fodder trade. Tractor trolleys are also important for fodder transportation along main highways for longer distances. Most of the inter-state and interregional trade is done by trucks.

In the case of inter-state movement of fodder, some very interesting patterns have emerged. Patna, Jehanabad, Nalanda, Sheikhpura, Lakhisarai and Rohtas, which are the fodder surplus districts, are the main supply centres for dry fodder. Patna is the biggest transit point for fodder marketing. The state that buys the most fodder from Bihar is Jharkhand, which is highly deficient in fodder supply from its own production. Bihar also imports fodder from other states, notably from Uttar Pradesh for wheat straw sold directly in the fodder deficit regions of north Bihar.

Information plays a critical role in fodder marketing. Different actors in the fodder market use different modes of communication to elicit information and contact their counterparts. Almost all fodder traders and agents own a cell phone, which helps them to contact buyers and sellers, especially when making contacts at a longer distance. However, face-to-face communication has not lost its significance. It is the next important mode, which is still popular among the petty traders in rural fodder markets.

Weight and measurement

Method of weighing and measurement varies with the type of feed. Different practices are adopted to determine the quantity of traded feed (Table-4). Both weighing and measurement by volume are practiced in the fodder trade. Usually sale and purchase of rice and wheat straw at the farm level are done on the basis volume. The quantity of fodder is determined as per the lot size, size and number of small bundles; and truck/ cart load. The method of weighing is also practiced by retailers where facilities are available. Type of fodder also determines the method of measurement of the fodder quantity. Although wheat is harvested manually in most of area of Bihar, it is thrashed mechanically by the specially designed thrashers which also chop the wheat straw in fine pieces-called bhusa. Practically all types of bhusa (chopped wheat straw) are sold by the lot size. Fodder transactions as per cart, tractor and truck loads also give fair estimates of weight and often become the basic units of sale.

Farmers sell paddy straw on the basis of counts of small bundles or by lot size made of thousand bundles by the producer farmers. A lot of thousand bundles weigh about 40 to 60 kgs. and sold at Rs 100 per bundle. Formal weighing procedure is also adopted. All bulk trades in fodder beyond farm are done on the basis of formal measurement. Small balances are also used to weigh the bundles/ sacks of fodder. For loaded trucks, tractors etc weighing bridges are used. These weighing bridges are installed at certain entry and exit points in urban and semi urban areas or along the side of important roads/ highways.

Table- 4: Method of measurement of fodder/concentrate

Actors of Fodder Marketing	Method of Weighing		
	Weighing	Counting	By lot
Producer	+	+++	++
Fodder trader	+++	-	-
Consumer	+++	++	++
Agent	-	-	-
Concentrate trader	+++	-	-
Concentrate miller	+++	-	-

Source: Primary level survey, +++ indicates most common practice

Price formation and determinants of price

About 95 percent of the dry fodders comprise paddy and wheat straw. Both of these are agricultural by-products that involve no additional production cost but supplement farmers' income when used for livestock production on farm or sold. The process of price determination is simple. Farmers either accept the prevailing market price of fodder in the nearby region or negotiate with the purchasers assuming the prevailing market price as a reference. Of course exigency of demand and availability of fodder are considered while prices are determined.

Deficit zones(north Bihar) often witness extremes of flood devastation and face critical shortage of livestock feed in consequence. Under such circumstances, the demand for livestock feed rises many fold and hence price negotiations are driven by the exigency of demand. Otherwise, in normal situations price negotiation remains supply driven. However, there are other considerations too that affect the fodder price (Table-5). Certain quality aspects like; good lustre, taste, cleanliness, softness, and moisture contents of fodder are considered while prices are determined. The fodders having all or some these good qualities receive premium price. Producers, therefore, often try to sort and grade their fodder considering these criteria.

Transportability and access are other important considerations. Purchasers/ traders usually prefer to procure fodder from such places which are connected with good roads. During PRA it was reported that even in the same village there was a price differential because of location of the source of fodder. The fodders stored along the roadsides received higher price compared to that which were stored remotely inside the village.

Table- 5: Factors affecting fodder price in Bihar.

Type of fodder	Colour & Lustre	Taste	Softness & Freshness	Cleanliness	Moisture content
Paddy Straw	+++	++	++	++	++
Wheat Straw	++	+++	++	++	++
Pulses Straw	++	++	++	+++	++

Source: Primary level survey, +++ indicates most common practice

It has also observed that 67 percent of the fodder producers succeeded in getting a higher price by making negotiations with the fodder traders / purchasers while 33 percent had no options to accept the offered (prevailing) price of the fodders. Traders usually consider the demand and supply scenario and accordingly offer the price.

Fodder prices in surplus and deficit zones and terms of sale

There has been a wide difference in the fodder prices between the surplus and deficit zones (Table 6). It is obvious that fodders prices in deficit zones are of 17 to 50 per cent higher than that of surplus zone(south Bihar). A quintal of paddy straw was sold at a price of Rs. 100/ qtl in the surplus zone. At the same time, the price of one quintal of paddy straw in the deficit zone was Rs. 150. The average price of wheat in the surplus zone was Rs. 200 per quintal whereas in deficit zone accounted to Rs. 300/ qtl. Price of cultivated green fodder is usually determined on the basis of its area. In surplus zones a hectare of green fodder is sold in the range of 15 to 25 thousand rupees. In deficit zone it is sold between 25 to 35 thousand rupees. Cut grasses and green fodders are also sold in some of the areas at the rate of Rs. 1 to 1.5 /kg.

Table- 6 Range and average of producer's price in surveyed area

Type of Fodder	Surplus (south Bihar)		Deficit (north Bihar)	
	Range	Average	Range	Average
Paddy straw (Rs/	75-125	100	125-200	150
Wheat straw (Rs/q)	125-250	200	200-500	300
Pulses straw	150-400	300	200-450	350
Green grass (Rs/115 Sq. feet)	300-500	400	500-700	500
Green grass bundle (app. 10 kg)	10-15	10	10-15	10
Sorghum per 10 steam bundle (in urban area)	--	--	10	10

Source: Primary level survey

Both cash and credit sales are practiced in the livestock feed market. Though cash sale is preferred but many a times, circumstances force the producers, sellers and consumer to facilitate fodder feed marketing on credit too. It is a common practice in livestock fodder market that traders purchase these items on credit, sell these in the market or to the consumers, clear the past dues of the supplier and again lift these items on credit. The responses of various traders, producers, agents and consumers are presented in Table 7. The proportion of producers selling fodder in cash and credit was fifty-fifty. The proportion of traders selling fodder in cash and credit was 57:43. A large proportion of consumers (64%) buy fodder by making cash payments.

Table- 7 Terms of selling of fodder/concentrate

Actors of fodder marketing	Cash	Credit
Producer	50	50
Fodder trader	57	43
Consumer	64	36

Source: Primary level survey

Constraints in feed marketing and suggestions for improvement

Fodder market in Bihar face several constraints. Many of these constraints are generic in nature and presently are not being addressed. Storage difficulties and lack of appropriate storage facilities seriously affect year-round availability of fodder. Most of the marketable surplus of fodder is generated by marginal and small farmers who are in the majority in the state, but have limited storage capacity. Due to difficulties in fodder storage, they are forced to sell immediately after harvest. Even if stored, a large proportion of fodder gets spoiled or destroyed due to improper storage facilities.

Transportation of fodder from producers to the market is fairly inefficient. Due to poor road conditions in rural areas and the absence of any block-making unit, transportation and transaction costs are very high. It is estimated that marketing 100kg of fodder generates revenues of Rs. 395, of which the fodder raw material accounts for about 32% only and the rest is the marketing cost includes transportation cost. The largest cost item is transportation which accounts for about 36%. Fodder is a bulky item, which makes its trading cumbersome and handling difficult. Some traders use compressing machines to make fodder blocks. This makes storage easy and transportation convenient, and so more cost effective. The majority of machines used for compressing fodder are obsolete. These machines, which were designed for the compression of jute in the jute factories during the colonial period, serve the purpose of traders and transporters to some extent, but are inefficient. There is a need to design and develop new economical and cost-effective machines to help the fodder sector. The Government of Bihar has planned to establish two plants for preparing feed blocks: one each in a fodder-deficit region (Samastipur) and in a feed-surplus region (Patna).

Conclusions

Livestock is an integral part of the rural economy in Bihar and fodder is a critical input for livestock development. The data indicate that a huge gap exists between demand and supply of both dry and green fodder. South Bihar comprising agro-climatic zones IIIA and IIIB are fodder surplus areas because of irrigated cultivation of paddy and wheat. Agro-climatic Zone I and Zone II are fodder deficit and mostly depend on fodder surplus regions for their requirements. Fodder production is seasonal, but demand is constant throughout the year or until the next crop season. Inadequate storage facilities and space sometimes force producers to dispose of much of their fodder rather than storing it for later use for their own needs or sale when prices are higher. To promote fodder production and trade, it is necessary to improve storage systems on-farm as well as en route to distant markets. Fodder markets are unorganized and informal and the role of the public sector/government is negligible. Most fodder markets occur without any dedicated market place, often along roadsides and without legal credentials. Having specific market places may facilitate flow of market information, increase interaction among buyers and sellers and facilitate transparency and competition leading to fairer prices.

Fodder is a bulky item, which makes its trading cumbersome and handling difficult. Some traders use compressing machines to make fodder blocks. It is important to develop cost-effective and efficient fodder compressing technology to ease handling and transportation as well as generate cost savings. Development of technology for cost-

effective and nutritive feed requires urgent attention and here public sector R&D can play an effective role which can also be done in public-private partnership mode.

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